The Ramifications of Product/Service-Systems on Mechatronic Design

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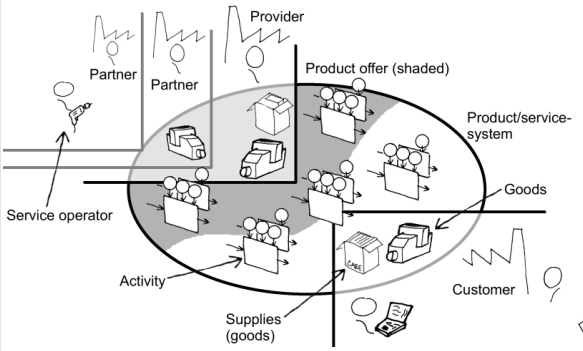

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The Ramifications of Product/Service-Systems on Mechatronic Design

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Agenda

- Why change to a product/service orientation?
- How do we understand Product/service-systems
- Widening PD in many dimensions
- Influences on mechatronic design
- Summary & Conclusions

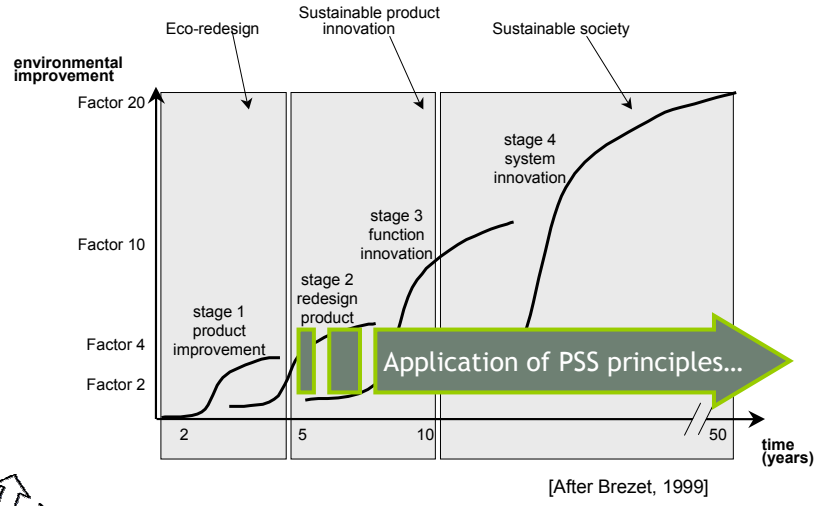
Why Product/service-systems: Business!

- In many industrial sectors there is an old tradition for delivering integrated solutions consisting of products and services: Aeroplanes, shipbuilding, medical equipment, …
- New trends force companies to rethink their business:
  - Individualisation of products changes the way of reasoning: ***from product to customer*** to ***from customer to product***
  - Changes in the cost structure force companies to seek for new ways of maintaining business lead:
    - More precise customer fit and customer understanding
    - More dynamic reactions to new needs
    - More precise, customer and company oriented use of new technology

Why Product/service-systems: Business!

- New possibilities for business enhancement are available:
  - Outsourcing, reducing costs, making new resources available
  - Networking, adding new competences, reaching new suppliers and new markets
  - E-business makes it possible to reach new customers in new domains, with new attitudes and behaviour
  - Dematerialisation of the products changes the dependency of delivery and transport
  - Knowledge-adding may raise the product's value and utility for the customers
- ***In this field of trends and possibilities we see a new pattern for business: The Product/Service-System approach***

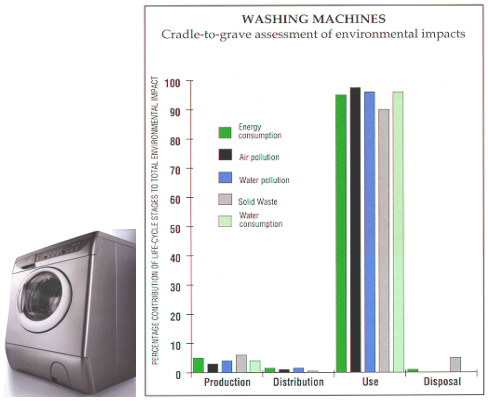
Why Product/service-systems: Environment!



[After Brezet, 1999]

Why Product/Service-Systems? Environment!

- Product usage
  - The emerging pattern of environmental load vs. responsibility



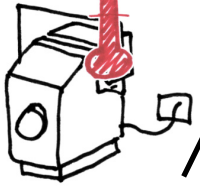
Traditional producer responsibility → + WEEE

Here's where the action is!

The difference between product properties and use properties

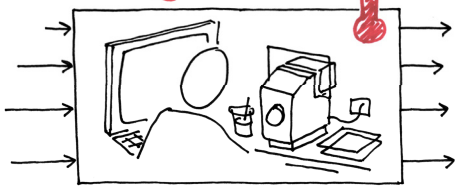
Functional properties
Operational p.
Ergonomic p.
Aesthetic p.
Distribution p.
Delivery & planning p.
Law conformance p.
Manufacturing p.
Economic p.
Liquidation p.

[Hubka]



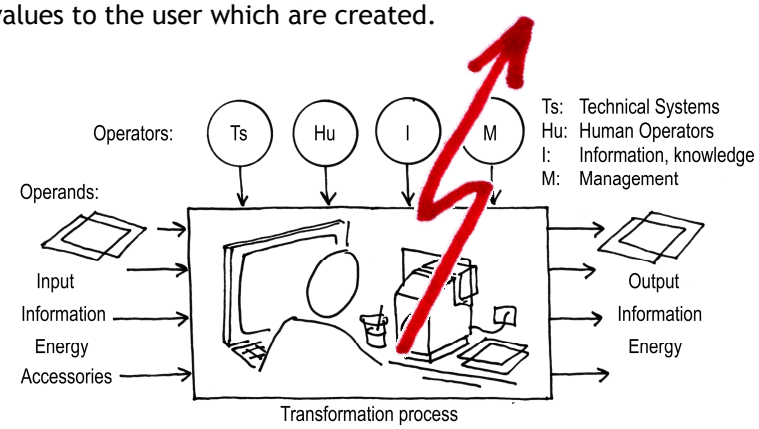
[Olesen]

Cost
Quality
Time
Efficiency
Flexibility
Risk
Env. effects



The use is related to a transformation

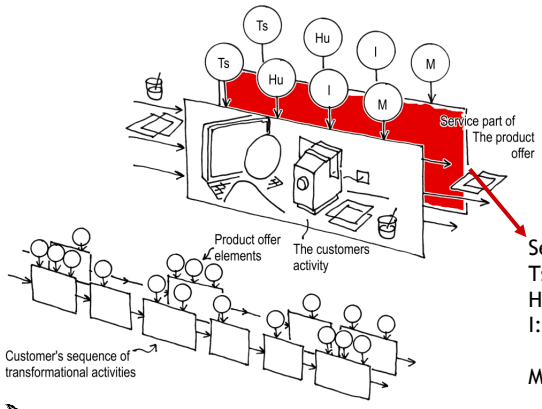
- The utility of the product is the result of the use and the values to the user which are created.



[Hubka]

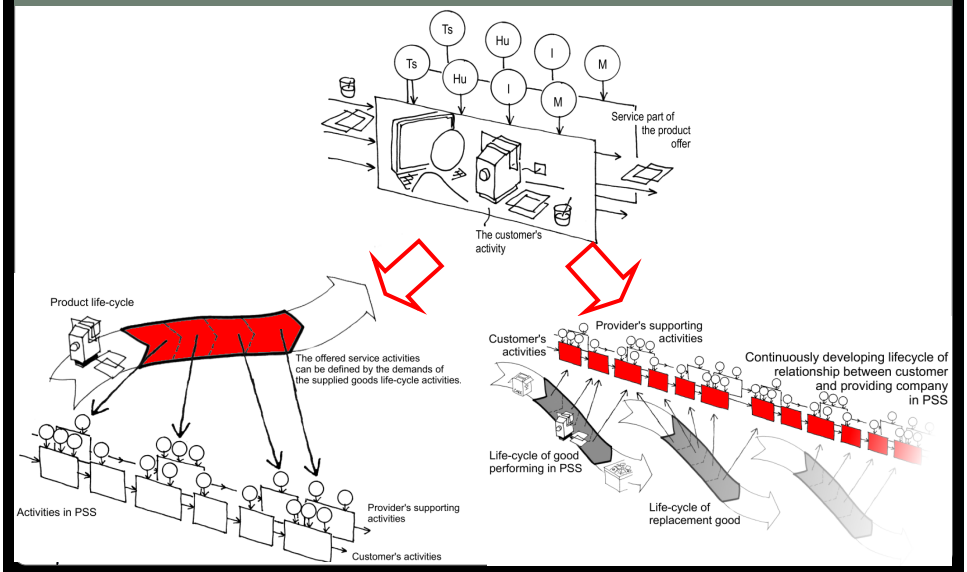
A service offer is executed within the customer's use process

- Service only exists, when the customer uses it!
- Postulate: Service is part of or in it self a transformation

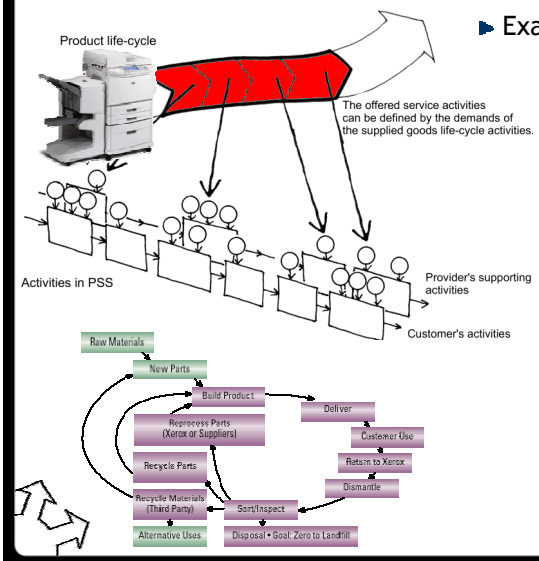


Service offers for instance:
Ts: Centralised Maintenance
Hu: Technicians executing operations
I: Receiving operation data and software support
M: Being under quality control (e.g. ISO:9000)

Our understanding of PSS

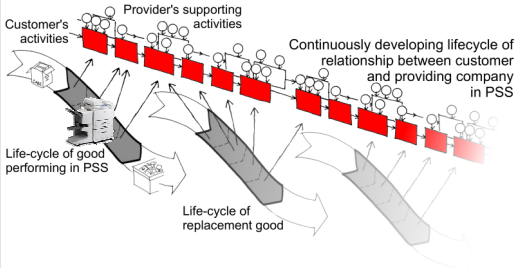


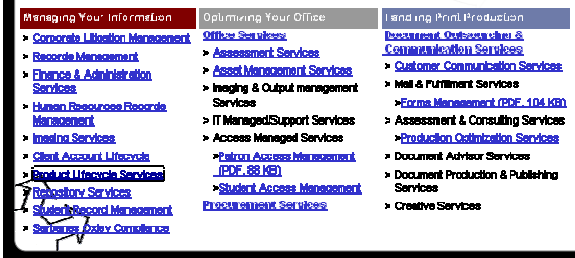
PSS types: Product life cycle dimension



- Example: Xerox
  1. Offering leasing options for equipment.
  2. Supplying paper (on order).
  3. Supplying toner & maintenance (automatic via www).
  4. Maintenance and repair services (automatic & on order).
  5. Replacing equipment.
  6. Reusing/refurbishing components.

PSS types: Customer relationship life cycle dimension

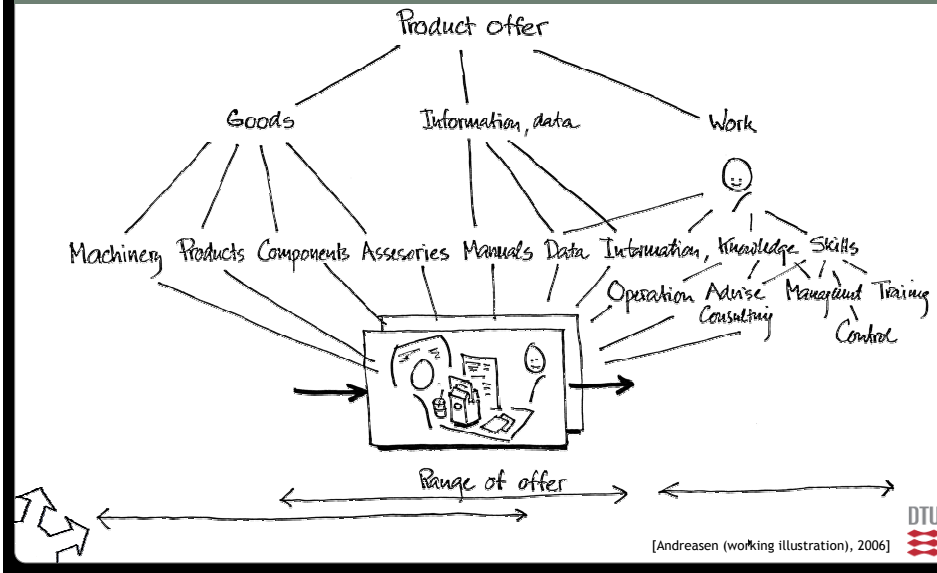




- Example: Xerox

1. Analysing current needs and practises of the customer.
2. Choosing management strategy.
3. Adapting the equipment to selected strategy (supplying new, integrating existing …).
4. Managing assets (as in previous slide).
5. Educating users (changing workflow).
6. Monitoring actual performance and adapting management.
7. …

An attempt to identify dimensions of offer development

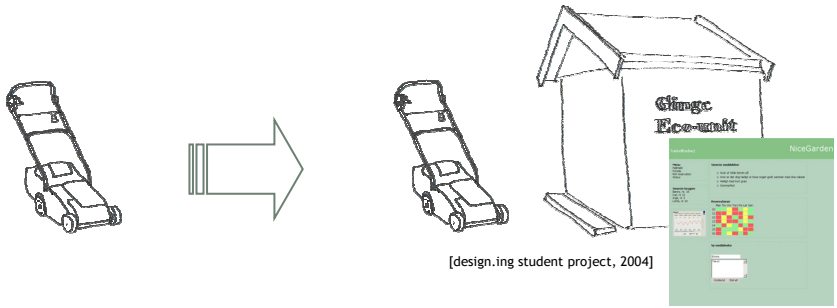


[Andreasen (working illustration), 2006]

A normative approach to PSS

Design & innovation 5th semester at DTU

- Example 1: From lawn mower to community garden depot



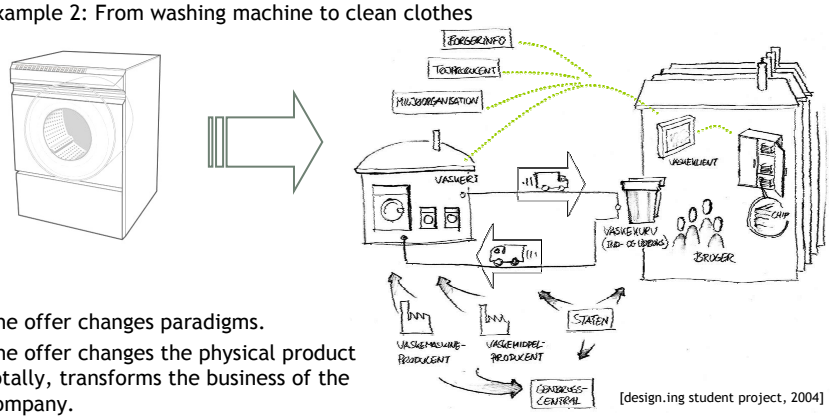
[design.ing student project, 2004]

- The offer adds network/sharing elements to the physical products.
- The offer adds information, management and maintenance activities to the company's operations.
- The effect is lower production volume, balanced by higher involvement in use, and continuous revenue from leasing based business model.

A normative approach to PSS

Design & innovation 5th semester at DTU

- Example 2: From washing machine to clean clothes



[design.ing student project, 2004]

- The offer changes paradigms.
- The offer changes the physical product totally, transforms the business of the company.
- The offer forces the company to seek new alliances (logistics, transportation…).
- The company's activities are changed profoundly, many new and different degrees of freedom are created.

Examples of implications

- If the configuration and adjustment of (mechatronic) machinery is done by the suppliers technicians or through electronic network the requirements for user interface design and functionality change radically.
- If the supplier offers periodic reconfiguration to adapt to current needs, the products must be modularised and have interfaces that enable reconfiguration after installation.
- If the supplier offers management and operations optimisation, the components delivered must be capable of recording, storing, processing and communicating information regarding their operational conditions.

Implications for Mechatronic Design

- The challenge for mechatronic design is the alignment of physical products with the Product/Service-offers they are part of.
- The number and properties of interfaces to other development areas change.
- The product consists not only of the single artefact - but stretches beyond that into the operational areas of the company (manufacturing, logistics, operations, maintenance, information management…)

Conclusions

- The adoption of a product/serivce-oriented view in product development adds new dimensions and stakeholders to the development task.
- To take full advantage of integrated development of physical products and services, mechatronic design must consider changing contexts in respect to…
  - who actually is operating the product in different use situations.
  - which stakeholders will influence the lifecycle of the product.
  - what implications there are in terms of recycling, reuse and remanufacturing.
  - how the products condition and operational states best can be communicated to the servicing, supporting and managing organisations.
  - etc.